

## BRIEFER ARTICLES.

### NOTES ON THE MAXIMUM THERMAL DEATH-POINT OF SPOROTRICHUM GLOBULIFERUM.

WHILE engaged in a study of an entomogenous fungus, *Sporotrichum globuliferum*, as an economic factor in the destruction of the chinch-bug, some experiments were made for the determination of the maximum thermal death point of this fungus under various conditions. The experiments were necessarily concluded when only some of the more evident results of higher temperatures had been secured as preliminary to more accurate investigations. Since it proved impossible to continue this work much further under similar conditions, some preliminary data are presented which are at least suggestive at times.

The original culture of the fungus was secured from a beetle, and the fungus is undoubtedly that which has been determined by Thaxter<sup>1</sup> as *Sporotrichum globuliferum* Speg. The cultures used in this experiment are one remove from stock tubes secured from the above mentioned dilution culture. All cultures were made on nutrient agar in slanting tubes, and every lot exposed to high temperatures was accompanied by checks at the room temperature. Since the checks constantly gave uniform growth, they are not included. Moreover, exposed tubes in which growth had failed were constantly re-inoculated and tested at room temperatures, and in all cases growth resulted.

In estimating quantity of growth it is difficult, with such tube-culture experiments, to make close comparisons in any case, and especially so where there is no distinct line of growth, but only several isolated centers. All sowings were made as streak cultures with an abundance of spores on the needle, and discrepancies might occasionally arise from the fact that spores adhering in small masses might be less penetrated by moisture, and hence more liable to survive.

In general, the approximate length of exposure required to cause death at the various temperatures is plainly indicated in the tables, and comment is unnecessary. Some details, however, may be noticed in connection with the tables.

<sup>1</sup> Seventeenth Report of the State Entomologist of Illinois, S. A. Forbes, 1895-6. 1899]



From drop cultures it was ascertained that germination might begin in a few hours; and in twenty-four hours there was considerable germination and growth about the spores. Again, at a uniform temperature, in two and one-half days, considerable aerial mycelium was developed, but rarely any spores, and this stage of growth was taken as the age limit for tests upon mycelium. (See table VI.)

For the tests with dry spores, as in table VII, fresh spores were exposed on glass slips, and then inoculations were made immediately therefrom.

TABLE I.  
35° C. AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Successive days	Result
1	Immediately	6 hours		Good growth
2	"	24 "		One center
3	"	Continuously		No growth
4	6 hours	24 hours		Good growth
5	24 "	24 "		Good growth
6	Immediately	6 "	2	Good growth
7	"	6 "	4	Good growth

It is of some interest that even at 35° an exposure of 24 hours quite effectually inhibits growth, when immediately exposed to this temperature (see exp. 2); while a few hours after germination may have begun, the same did not hold true.

TABLE II.  
37.7° C. AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Successive days	Result
8	Immediately	6 hours		Good growth
9	"	9 "		Good growth
10	"	18 "		Good growth
11	"	24 "		No growth
12	"	Continuously	One week	No growth
13	6 hours	24 hours		Good growth
14	15 "	24 "		Good growth
15	24 "	24 "		Good growth

The results at 37.7° C. repeat and confirm those of table I, in that freshly sown spores are readily killed in twenty-four hours, while those



which have lain some hours in conditions favorable for germination are capable of further growth after exposure.

TABLE III.  
40.5° C. AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Successive days	Result
16	Immediately	6 hours		Good growth
17	"	9 "		Good growth
18	"	18 "		Good growth
19	"	24 "		No growth
20	"	Continuously		No growth
21	6 hours	6 hours		Good growth
22	15 "	6 "		Good growth
23	24 "	6 "		Good growth
24	6 "	24 "		One center
25	15 "	24 "		Two centers
26	24 "	24 "		No growth
27	Immediately	3 "	2	Two centers
28	"	3 "	4	No growth
29	"	6 "	2	No growth
30	"	6 "	4	No growth

TABLE IV.  
46.1° C. AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Successive days	Result
31	Immediately	1 hour		Good growth
32	"	3 hours		Few centers
33	"	6 "		No growth
34	"	9 "		No growth
35	"	18 "		No growth
36	6 hours	1 hour		Good growth
37	15 "	1 "		Good growth
38	24 "	1 "		Good growth
39	6 "	3 hours		Fair growth
40	15 "	3 "		Good growth
41	24 "	3 "		Good growth
42	6 "	6 "		One center
43	15 "	6 "		Three centers
44	24 "	6 "		Six centers
45	6 "	12 "		Three centers
46	15 "	12 "		Four centers
47	24 "	12 "		No growth
48	6 "	24 "		No growth
49	15 "	24 "		One center
50	24 "	24 "		No growth
51	Immediately	1 hour	2	No growth
52	"	1 "	4	No growth



TABLE V.  
51.6° C. AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Successive days	Result
53	Immediately	1 hour		Four centers
54	"	3 hours		No growth
55	"	6 "		No growth
56	6 hours	1 hour		Six centers
57	15 "	1 "		One center
58	24 "	1 "		No growth
59	6 "	3 hours		One center
60	15 "	3 "		No growth
61	24 "	3 "		No growth
62	6 "	6 "		No growth
63	15 "	6 "		No growth
64	24 "	6 "		No growth
65	Immediately	1 hour	2	No growth
66	"	1 "	4	No growth

TABLE VI.  
MYCELIUM, AGAR CULTURES.

Exp. no.	When exposed, after sowing	Length of time exposed	Tempera- ture, deg. C.	Successive days	Result
67	2½ days	6 hours	37.7		New growth
68	2½ "	24 "	37.7		New growth
69	2½ "	6 "	40.5		New growth
70	2½ "	24 "	40.5		New growth
71	2½ "	6 "	40.5	2	Four centers new growth
72	2½ "	6 "	40.5	4	No new growth
73	2½ "	1 hour	46.1		New growth
74	2½ "	3 hours	46.1		New growth
75	2½ "	6 "	46.1		Fair new growth
76	2½ "	12 "	46.1		Three centers new growth
77	2½ "	24 "	46.1		No new growth
78	2½ "	1 hour	46.1	2	New growth
79	2½ "	1 "	46.1	4	Few centers new growth
80	2½ "	3 hours	46.1	2	New growth
81	2½ "	3 "	46.1	4	One center new growth
82	2½ "	6 "	46.1	2	One center new growth
83	2½ "	6 "	46.1	4	No new growth
84	2½ "	1 hour	51.6		New growth
85	2½ "	3 hours	51.6		New growth
86	2½ "	6 "	51.6		No new growth
87	2½ "	12 "	51.6		No new growth
88	2½ "	24 "	51.6		No new growth
89	2½ "	1 hour	51.6	2	No new growth
90	2½ "	1 "	51.6	4	No new growth



Table III shows less difference between immediate and delayed exposures to the higher temperature.

In table IV it is again evident that longer exposures were necessary to kill all of the spores when germination might have begun.

The limits of growth in table V are very well indicated, and the effects of immediate and delayed exposures are for the first time practically the same.

TABLE VII.  
SPORES EXPOSED TO DRY HEAT.

Exp. no.	Length of time exposed	Temperature	Successive days	Result
91	6 hours	51.6		Good growth
92	3 "	54.4		Good growth
93	6 "	54.4		Good growth
94	1 hour	60		Good growth
95	6 hours	46.1	2	Good growth
96	6 "	46.1	4	Good growth
97	3 "	51.6	2	Ten centers of growth
98	3 "	51.6	4	No growth

Unfortunately the maximum amount of dry heat which the spores of this fungus will resist during a single exposure was not ascertained.

Below are given some results at various temperatures with the mycelium of this fungus when grown upon chinch-bugs.

TABLE VIII.  
MYCELIUM, CULTURES ON INSECTS.

Exp. no.	Growth	Length of time exposed	Temperature Deg. C.	Successive days	Result
99	Mycelium	6	46.1		New growth on some
100	"	24	46.1		New growth on some
101	"	3	46.1	4	New growth on some
102	"	6	46.1	4	New growth on some
103	"	3	51.6		New growth on all
104	"	6	51.6		New growth on some
105	"	1	51.6	4	New growth on some
106	"	3	51.6	4	New growth on all

In the experiments of table VIII, a number of dead bugs were dusted with the spores, and in a day or so, when there was considerable aerial growth of mycelium along the body sutures, exposures were



made. The thermal death point was not ascertained, but it is evidently much above that of the mycelium grown upon agar (see table VI). The fact that new growth, or further growth, did not appear upon some of the insects was expected, since sterilization precautions could not there be observed, and foreign molds were sometimes present.—B. M. DUGGAR, *Cornell University, Ithaca, N. Y.*

## DESCRIPTIONS OF TWO WILLOWS FROM CENTRAL MEXICO.

(WITH FIGURES 1, 2.)

THE two willows here described were collected by Mr. Pringle at Sierra de Ajusco in the state of Mexico. They were collected at an altitude of 10,000 feet. The descriptions of Mexican willows are meager and imperfect. Anderson in the *Prodromus* gives them very little attention, probably having only scanty material from that region, and with very little literature from which to make up descriptions.

The writer wishes to express his gratitude to Dr. Robinson and Mr. Greenman of the Gray Herbarium not only for the opportunity to study the specimens but also for much information regarding the Mexican species.

**Salix Pringlei**, n. sp.—Shrub 1 to 2<sup>m</sup> high: twigs of season's growth minutely hoary puberulent, older shoots dull olive green or brownish: leaves in veneration densely tomentose and slightly ferruginous, at maturity becoming nearly glabrous and dark green above, paler and velvety tomentose beneath, entire (or obscurely crenate on vigorous young shoots), elliptical, acute at both ends, largest 6<sup>cm</sup> by 2<sup>cm</sup>, on petioles 5<sup>mm</sup> long; stipules none: pistillate ament at anthesis nearly sessile in its leafy bracts, 2<sup>cm</sup> long by 1<sup>cm</sup> thick, subcylindrical: young capsule ovate-lanceolate, densely tomentose, grayish, 3<sup>mm</sup> long, very short pedicelled; scale twice the length of the pedicel, elliptical, black, with rather long crisp hairs on its margin; gland small, one-half as long as the pedicel; style very short; stigmas bifid: pistillate aments at maturity large (6–8<sup>cm</sup> long by 2<sup>cm</sup> thick), on short leafy peduncles less than a centimeter long bearing 3 or 4 small green leaves: mature capsules lanceolate conical on glabrous pedicels.

This description is based on Mr. Pringle's no. 6795. No staminate plant was collected. The species is related to *S. candida* which it